How the energy transition can be achieved

Allensbach: blueprint for “Energiewende”

Smart Grid 2.0

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Summary

The future of highly volatile renewable energy systems relies on flexible consumer behavior, cost-effective storage and high levels of decentralization to limit grid expansion and electricity cost. Sector coupling of electricity, heat and cooling will play a major role here - also in the area of complementary generation of electricity. Throw the minimization of the transaction costs it will be possible to activate even the smallest flexibilities, achieving a more cost-effective and efficient energy transition. At the same time, a difficult task has to be solved, to make system complexity manageable and to maintain security of supply.

Decentralized energy management based on grid state variables (Smart Grid 2.0) enables to meet these requirements. At the same time, the European Commission's demands for variable prices and better market access for consumers are met throw easier supplier choice, transparent pricing and the ability to easily generate and market electricity on their own. The presentation uses the example of Allensbach as a model community to show future energy scenarios, development paths and pricing within a future simplified regulation.

The project

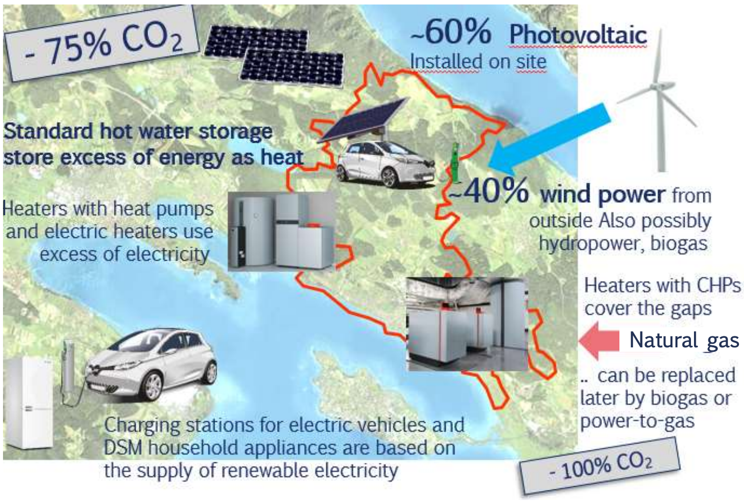
1. Model scenario

Allensbach - known as the seat of the Institute for Public Opinion Research - is a municipality on Lake Constance with just over 7000 inhabitants. With a typical German population density and building structure in the residential and service sector, Allensbach offers itself as a model for the energy transition in this area. The implementation of the energy transition is here particularly challenging, because of the embedded in landscape, nature reserves and the extension of the settlement. Nevertheless, an economic future scenario can be outlined:

As a result of the heat/cold and electricity sector coupling, around 80% of the solar and wind energy can be coupled into the local power grid. With a mix of 60% locally generated PV and 40% external wind power, the power grid has to be only minimally expanded. Electricity gaps are covered by micro CHP. Surpluses are consumed by heat pumps. In winter, these systems are coupled via the electricity grid as virtual gas heat pumps. The cogeneration plants are operated in a transitional phase with natural gas, which can be replaced later by regenerative gas. The gas consumption can be minimized by using micro load management to such an extent that even in the natural gas scenario, with the inclusion of electromobility, 75% CO2 can be saved.

2. Dezentralized energy management

To realize micro-load management, a price-based system is necessary, because only then the high complexity becomes manageable. In order to ensure system stability and data security, the Smart Grid 2.0 solution approach determines the price signal directly from physical network state variables such as the grid frequency or the terminal voltage. The decentralized control intelligence is distributed to each individual device. It can be shown that the ICT costs are reduced by a factor of 100 to 1000 in comparison. The use of micro CHP / fuel cells maximizes efficiency and pays off by avoiding heat networks and energy losses.



3. Business models

The current regulation of the energy markets seeks to support the use of regenerative energies and the relief of networks by promoting self-consumption models. The problem is that the promotion of storage technologies is at the expense of revenues for the existing network infrastructure. In addition, the balancing of remaining imbalances in the network and the consideration of network bottlenecks is very complex.

Smart Grid 2.0 technology can support existing models and allows for advanced models that eliminate these disadvantages through simple variable remuneration and compensation.